Title: Let's Have a Pizza Party

Brief Overview:

This unit will provide students with an opportunity to engage in a real-life problem-solving situation whereby they will determine the number of possible combinations of toppings on a pizza. In addition, students will collect and analyze data about cost and size to determine which pizza is the better buy based on unit price.

Links to NCTM 2000 Standards:

- **Mathematics as Problem Solving, Reasoning and Proof, Communication, Connections, and Representation**
  These five process standards are threads that integrate throughout the unit, although they may not be specifically addressed in the unit. They emphasize the need to help students develop the processes that are the major means for doing mathematics, thinking about mathematics, understanding mathematics, and communicating mathematics.

  Students will demonstrate their ability to apply a wide variety of strategies to solve problems and adapt the strategies to new situations. They will demonstrate their ability to make and investigate mathematical conjectures. Students also will demonstrate their ability to organize and consolidate their mathematical thinking to communicate coherently and clearly with peers and teachers. Furthermore, they will demonstrate their ability to recognize and use connections among different mathematical ideas and to learn about mathematics in contexts outside of mathematics. Last of all, students will demonstrate their ability to create and use representations to organize, record, and communicate mathematical ideas purposefully, flexibly, and numerically.

- **Number and Operation**
  Students will demonstrate their ability to use computational tools and strategies fluently. They will demonstrate their ability to understand the meaning of operations and how they relate to each other.

- **Geometry and Spatial Sense**
  Students will demonstrate their ability to apply properties of two-dimensional geometric objects.

- **Data Analysis, Statistics and Probability**
  Students will demonstrate their ability to organize and represent data to answer questions. They will demonstrate their ability to interpret data and develop and evaluate predictions and arguments that are based on data.

Grade/Level:

Grades 6, 7, and 8

Duration/Length:

4-5 days

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Constructing and interpreting graphs

- Basic operations with decimals and whole numbers
- Calculating the area of a circle given the diameter
- Calculating the area of a square
- Calculating unit price

Student Outcomes:

Students will be able to:

- determine the total number of combinations that can be made using 5 given toppings on a pizza.
- collect, organize, and interpret data on a bar graph.
- calculate the unit price of items.
- compute the area of a circle and a square.
- work cooperatively in a real-life problem-solving activity
- analyze the results of data in order to justify which item is the better buy.

Materials/Resources/Printed Materials:

- Calculator
- Colored pencils
- Worksheets
- Prelutsky, Jack. *A Pizza the Size of the Sun*. New York: William Morrow & Company, Inc. 1996. p. 7.

Development/Procedures:

- Task 1
  Distribute "Let's Have a Pizza Party" Tasks 1 and 2 Worksheets.
  Read the poem "A Pizza the Size of the Sun" aloud.
  Have students complete Task 1 independently.

- Task 2
  Distribute "Pizza Possibilities" Worksheet.
  Have students complete Task 2A in cooperative groups.
  Have students complete Task 2B individually.
  Have students share explanations.

- Task 3
  Model an example for finding different numbers of combinations prior to the task.
  Distribute menu sheet and calculators.
  Lead discussion to answer questions such as:
    - What are the two pizza companies we are comparing?
    - How would you decide who has the better pizza?

  Distribute Task 3 Worksheet.
  Have students complete Task 3 in cooperative groups

- Task 4
  Distribute Task 4 Worksheet.
  Have students complete Task 4A in cooperative groups.
  Have students complete Task 4B individually.
  Have students share responses.

- Task 5
  Review the terms independent and dependent variable with the students.
  Distribute Task 5 Worksheet and colored pencils.
  Have students discuss Task 5A in cooperative groups.
  Have students complete Task 5B independently.
  Have students share explanations and display graphs as a class.

- Assessment
  Distribute Tasks 4 and 5 Worksheets to students.
  Distribute "What About A Square Pizza?" Worksheet .
  Distribute "'Pizza Squared' Square Pizza Prices" Graph.
  Have students complete individually.

Performance Assessment:

Student assessment will be based on completion of Tasks 1-5, and the performance assessment "What About A Square Pizza?". A general rubric can be used for all activities, which is included.

Extension/Follow Up:

- Students will determine the pizza that is the best value when they are part of a special sale.
- Students will compare the unit price of a small and large pizza to determine the best value.
- Students will explore permutations and combinations using a calculator.

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Let's Have a Pizza Party!!

Task 1: Reading for Information

Using the poem " A Pizza the Size of the Sun", list five different toppings Jack placed on his pizza.

_____ _____ _____

_____ _____

Task 2: Pizza Possibilities

Find the number of different pizza combinations that are possible using the five toppings from Task 1. You may use the "Pizza Possibility" Worksheet to get started.

A. With your group, complete the chart below.

Toppings	Total Number of Possibilities
0	
1	
2	
3	
4	
5	

B. Explain how you determined the number of pizza combinations.

_____

_____

_____

_____

Task 3: Best Plain Pizza Buy

Based upon the class discussion, how will you as the consumer decide which pizza is the better buy?

Use the menus to answer the questions below.

A. Predict which pizza is the better buy and explain why.

_____

_____

B. What is the cost of a plain small pizza at each company?

_____ Pizza Palace

_____ Pizza World

C. What is the radius of each small pizza at each company?

_____ Pizza Palace

_____ Pizza World

D. Using the formula for the area of a circle, calculate the area of each pizza. Record your final answers in the space below.

_____ Pizza Palace

_____ Pizza World

E. Calculate and compare the unit price of each small pizza. (Hint: Price/Area). Record your final answers in the space below.

_____ Pizza Palace

_____ Pizza World

Task 4: Top Off Your Pizza

Unfortunately not every one likes just plain pizza. Therefore, you need to find which company has the best unit price for a small pizza with 0, 3, and 5 toppings.

A. First, record your findings from Task 3E, the unit price for a zero topping pizza.
Next, find the unit price for a pizza with three toppings.
Then, find the unit price for a pizza with five toppings.

Record your answers in the chart.

Toppings	Pizza Palace	Pizza World
0		
3		
5		

B. Explain how you solved the above problem. Support your answer mathematically.

_____

_____

_____

_____

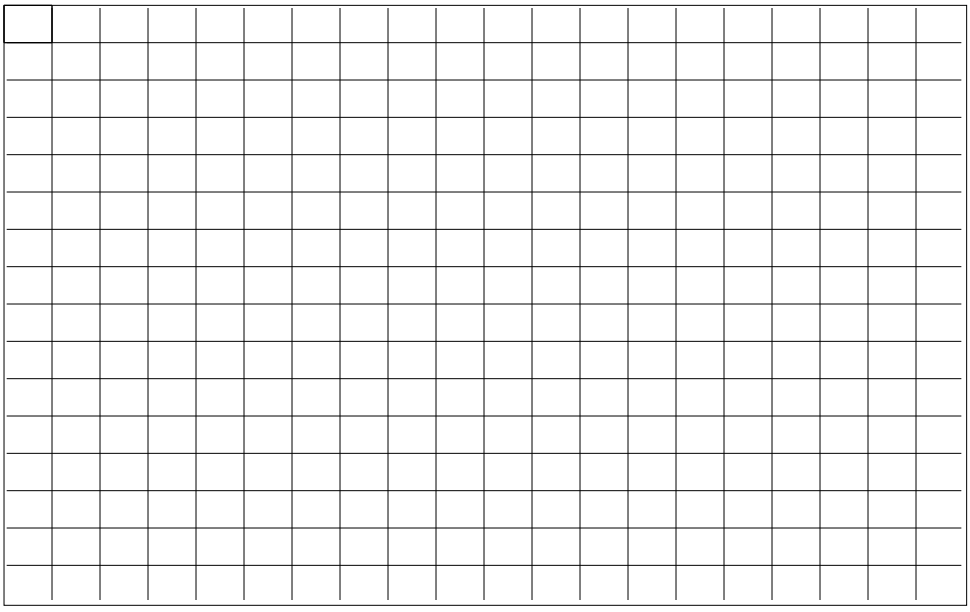
Task 5: Creating a Graph

Construct a graph to display the data from the chart in Task 4A.

A. What is the 1. independent variable (x) _____

2. dependent variable (y) _____

B. Create a double bar graph to show the unit price of the plain, three topping, and five topping pizza for each company. Use colored pencils.



C. Analyze your graph to determine which pizza you would want to buy, based on the unit price. Justify your answer.

_____

_____

_____

_____

D. In real life, what factors influence you to buy a pizza?

_____

_____

_____

_____

_____

_____

What About A Square Pizza?

Another company has just opened in the neighborhood and they make their pizza a square with 14 inch sides. This presents you with a new problem. Could the square pizza be a better buy?

You will need to use the graph "'Pizza Squared' Square Pizza Prices" and the information from Tasks 4 and 5 to complete the following activities.

A. How many toppings do you want on your pizza? _____

B. Is Pizza Palace or Pizza World a better buy for that number of toppings? _____

C. Below, record the size and unit price for that pizza.

Size in inches _____ Unit Price _____

D. If you had to decide between the square or round pizza, with the same number of toppings, which would be the best buy?

Answer:

The best buy would be _____.

E. Explain which pizza is a better buy. Support your answer mathematically.

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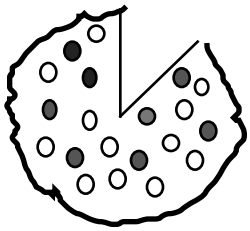
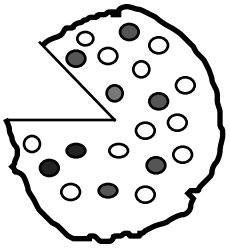
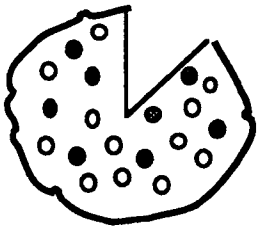


Pizza Possibilities



Directions - Use this sheet to explore the different pizza combinations using the toppings in Task 1. You may use this sheet or create your own way of calculating the combinations. You may draw more circles if needed.

Since 1996



Pizza Palace

Fresh New England Round Pizza

	Small (12")	Large (16")
Tomato & Cheese First topping is free	$5.95	$7.45
Each additional topping	$.55	$.55

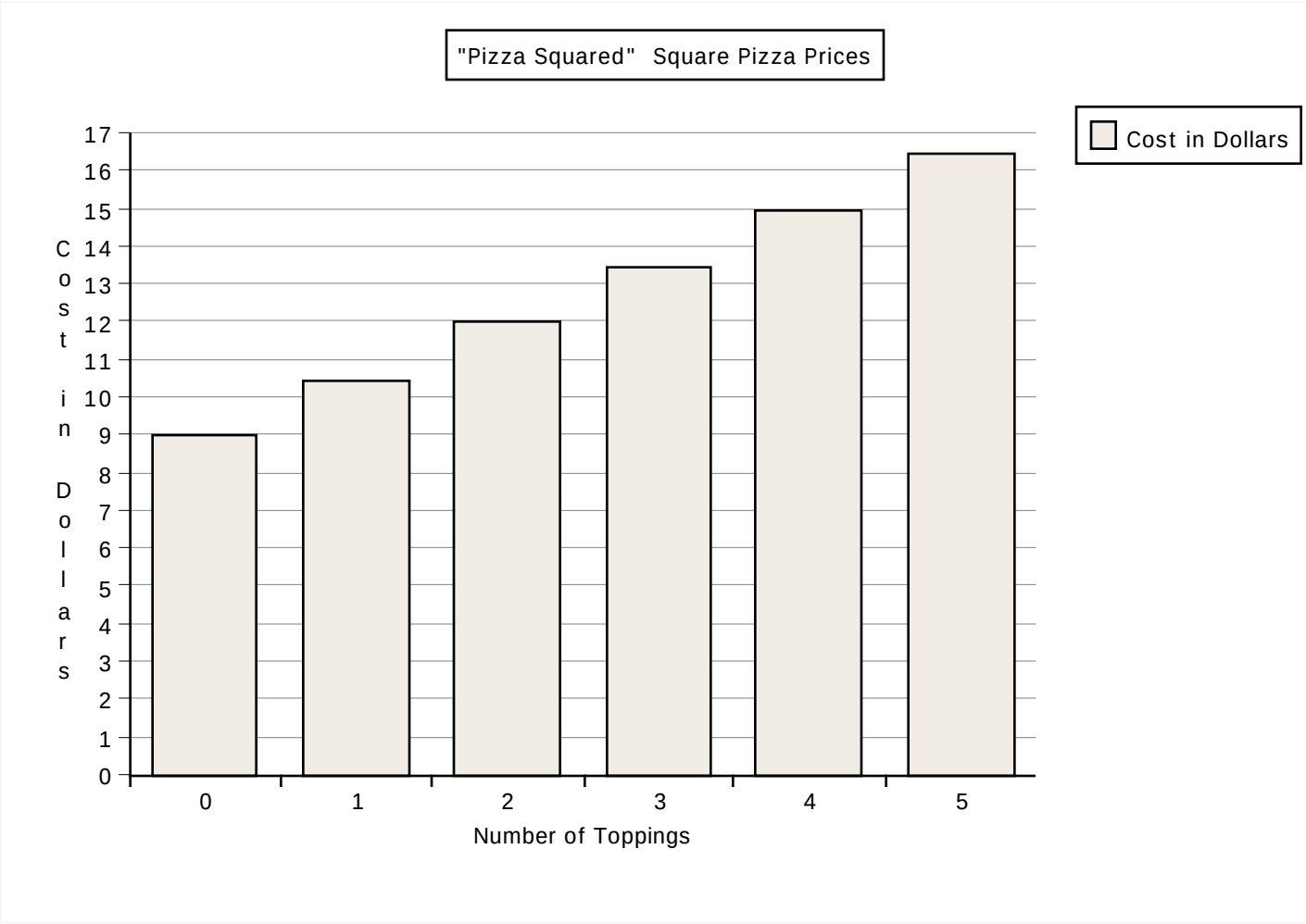
Pizza World

Daily Lunch Specials!

New England Style Round Pizza

	Small (10")	Large (14")
Plain Cheese	$4.50	$6.75
Each additional topping	$.50	$1.00

Open 11 AM to 12 Midnight


"Pizza Squared" Square Pizza Prices
Cost in Dollars
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Cost in Dollars
0
1
2
3
4
5
Number of Toppings

Answer Keys: Let's Have a Pizza Party!!
What About A Square Pizza?

Task 1: Reading for Information

Students should list 5 of the following toppings from the poem: cheese, peppers, pimentos, peas, mushrooms, tomatoes, sausage, or olives.

Task 2: Pizza Possibilities

Toppings	Total Number of Possibilities
0	1
1	5
2	10
3	10
4	5
5	1

B. Students should explain the processes they used to arrive at their answers in Task 2A. Answers might include creating a chart, table, or drawing pictures. Students may state that the order of the combination is not significant in determining the total number of possibilities.

Task 3: Best Plain Pizza Buy

A. Student responses will vary.

B. Pizza Palace:$5.95 Pizza World: $4.50

C. Pizza Palace: 6" Pizza World: 5"

D. Pizza Palace:Area = πr^2 Pizza World: Area = 78.5 in^2

Area = $\pi 6^2$

Area = 3.14 x 36

Area = 113.04 in^2

E. Pizza Palace: **Unit Price = total cost/area**
Unit Price = \$5.95/113.04 in^2
Unit Price = \$.05 per in^2

Pizza World: **Unit Price = \$.06 per in^2**

Task 4: But I Don't Like Plain Pizza

Students will need to add in the cost of the additional toppings found on the menu. The total price for each pizza will be as follows:

	Pizza Palace	Pizza World
O toppings	\$5.95	\$4.50
3 toppings	\$7.05	\$5.50
5 toppings	\$8.15	\$6.50

The prices above will be used by students when determining the unit price for each pizza.
The unit price for each type of pizza is:

Toppings	Pizza Palace	Pizza World
0	0.05	0.06
3	0.06	0.08
5	0.07	0.09

B. Mathematical communication should be clear and demonstrate an understanding of how to determine the unit price of an item. In addition, students should realize that Pizza Palace offers a larger size pizza for less money per unit. Therefore, it is the better value.

Task 5: Creating a Graph

A. 1. independent variable (x) number of toppings
2. dependent variable (y) unit prices

B. Student graphs should include all the elements of a graph, be colorful, and accurate.

C. Students should be able to cite examples from their graph to support their answer that Pizza Palace is the better value pizza.

D. Student responses will vary. Some possible answers might include coupons, specials, taste, location, advertisement, recommendations, and delivery availability.

<u>Performance Assessment: What About A Square Pizza?</u>

D.

0 Toppings:	**Pizza Palace - unit price $.05**
	***Pizza Squared - unit price $.04**
3 Toppings:	***Pizza Palace - unit price $.06**
	Pizza Squared - unit price $.07
5 Toppings:	***Pizza Palace - unit price $.07**
	Pizza Squared - unit price $.08

*** Represents the better buy**

E. Students should be able to support their answer mathematically, making sure to include unit price.

Scoring Rubric

Response Levels:

3 **Student demonstrates the knowledge and skills needed to complete the task. Student clearly communicates mathematical ideas, processes, and concepts.**

2 **Student partially demonstrates the knowledge and skills needed to complete the task. Student communication of mathematical ideas, processes, and concepts is somewhat limited.**

1 **Student demonstrates a fragmented understanding of the knowledge and skills needed to complete the task. Student communication of mathematical ideas, processes, and concepts is vague.**